

WHAT IS CLAIMED IS:

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1. A planet gear carrier for a bicycle hub transmission comprising:  
a first carrier member including a first carrier member axle opening for receiving an axle therethrough and including a plurality of first planet gear openings for receiving a plurality of first planet gears;  
a separate second carrier member having a second carrier member axle opening for receiving the axle therethrough; and  
wherein the first carrier member is fastened to the second carrier member.
2. The planet gear carrier according to claim 1 further comprising a coupler for nonrotatably coupling the first carrier member to the second carrier member.
3. The planet gear carrier according to claim 2 wherein the coupler comprises a carrier pin that extends from a side of one of the first carrier member and the second carrier member into the side of the other one of the first carrier member and the second carrier member.
4. The planet gear carrier according to claim 3 wherein the carrier pin extends from the side of the first carrier member.
5. The planet gear carrier according to claim 3 wherein a debris space is formed between the first carrier member and the second carrier member surrounding the carrier pin.
6. The planet gear carrier according to claim 5 wherein the first carrier member includes a recess that forms the debris space.
7. The planet gear carrier according to claim 1 wherein the first carrier member includes a radially inwardly extending wall for axially retaining a sun gear.

8. The planet gear carrier according to claim 1 further comprising:  
a pinion pin disposed in each of the plurality of first planet gear openings and supported by at least one of the first carrier member and the second carrier member; and  
a planet gear rotatably supported on each pinion pin.

9. The planet gear carrier according to claim 1 wherein the first carrier member includes a plurality of second planet gear openings for receiving a plurality of second planet gears.

10. The planet gear carrier according to claim 9 wherein the plurality of first planet gear openings is disposed on a first side of the first carrier member, and wherein the plurality of second planet gear openings are disposed on a second side of the first carrier member.

11. The planet gear carrier according to claim 10 wherein the second carrier member is fastened to the first side of the first carrier member, and further comprising:

a separate third carrier member having a third carrier member axle opening for receiving the axle therethrough; and

wherein the third carrier member is fastened to the second side of the first carrier member.

12. The planet gear carrier according to claim 11 further comprising:

a first coupler for nonrotatably coupling the first carrier member to the second carrier member; and

a second coupler for nonrotatably coupling the first carrier member to the third carrier member.

13. The planet gear carrier according to claim 12 wherein the first coupler comprises a first carrier pin that extends from one of the first side of the first carrier member and a side of the second carrier member into the other one of the first side of the first carrier member and the side of the second carrier member, and wherein the second coupler comprises a second carrier pin that extends from one of the second side of the first carrier member and a side of

the third carrier member into the other one of the second side of the first carrier member and the side of the third carrier member.

14. The planet gear carrier according to claim 13 wherein the first carrier pin extends from the first side of the first carrier member, and wherein the second carrier pin extends from the second side of the first carrier member.

15. The planet gear carrier according to claim 14 wherein a first debris space is formed between the first carrier member and the second carrier member surrounding the first carrier pin, and wherein a second debris space is formed between the first carrier member and the third carrier member surrounding the second carrier pin.

16. The planet gear carrier according to claim 15 wherein the first carrier member includes a first recess that forms the first debris space and a second recess that forms the second debris space.

17. The planet gear carrier according to claim 11 further comprising:  
a first pinion pin disposed in each of the plurality of first planet gear openings and supported by at least one of the first carrier member and the second carrier member;  
a first planet gear rotatably supported on each first pinion pin;  
a second pinion pin disposed in each of the plurality of second planet gear openings and supported by at least one of the first carrier member and the third carrier member; and  
a second planet gear rotatably supported on each second pinion pin.

18. The planet gear carrier according to claim 17 wherein the first pinion pin is one piece with the second pinion pin to form a master pinion pin.

19. The planet gear carrier according to claim 18 wherein the master pinion pin is supported by the first carrier member, and further comprising a bushing disposed between the first carrier member and the master pinion pin for rotatably supporting the master pinion pin.

20. The planet gear carrier according to claim 19 further comprising a stopper ring groove disposed on at least one of the first carrier member and the third carrier member for axially fixing the first pinion pin and the second pinion pin.

21. The planet gear carrier according to claim 11 further comprising a fastener for fastening the first carrier member, the second carrier member and the third carrier member together.

22. The planet gear carrier according to claim 21 wherein the fastener comprises a rivet that extends through the first carrier member, the second carrier member and the third carrier member.

23. The planet gear carrier according to claim 11 wherein the plurality of first planet gear openings open through the first side of the first carrier member, and wherein the plurality of second planet gear openings open through the second side of the first carrier member.

24. The planet gear carrier according to claim 11 wherein the third carrier member includes a plurality of pawl receiving recesses.

25. The planet gear carrier according to claim 24 wherein the plurality of pawl receiving recesses are disposed on an outer peripheral surface of the third carrier member.

26. The planet gear carrier according to claim 11 wherein the first carrier member directly contacts the second carrier member and the third carrier member.

27. The planet gear carrier according to claim 11 wherein the first carrier member includes a radially inwardly extending wall for axially retaining a sun gear.

28. The planet gear carrier according to claim 11 wherein each of the plurality of first planet gear openings is larger than each of the plurality of second planet gear openings.

29. The planet gear carrier according to claim 11 wherein each first planet gear opening is located directly opposite a corresponding second planet gear opening, and further comprising:

a plurality of pairs of first carrier pins for nonrotatably coupling the first carrier member to the second carrier member, wherein each pair of first carrier pins is disposed between a corresponding pair of the first planet gear openings;

63 a plurality of pairs of second carrier pins for nonrotatably coupling the first carrier member to the third carrier member, wherein each pair of second carrier pins is disposed between a corresponding pair of the second planet gear openings;

wherein each pair of first carrier pins is located opposite a corresponding pair of the second carrier pins;

a rivet disposed between each pair of first carrier pins and each pair of second carrier pins and extending through the first carrier member, the second carrier member and the third carrier member;

a plurality of pinion pins, each pinion pin extending through the first carrier member into a corresponding first planet gear opening and second planet gear opening;

a first planet gear rotatably supported in each first planet gear opening; and

a second planet gear rotatably supported in each second planet gear opening.

30. The planet gear carrier according to claim 11 wherein the first side of the first carrier member is substantially parallel to the second side of the first carrier member.

31. The planet gear carrier according to claim 11 wherein the first carrier member includes a first guide rib that engages the second carrier member, and wherein the third carrier member includes a second guide rib that engages the first carrier member.

32. The planet gear carrier according to claim 11 wherein the first carrier member is formed from a different material than at least one of the second carrier member and the third carrier member.

33. The planet gear carrier according to claim 32 wherein the first carrier member is formed of a light alloy metal.

34. The planet gear carrier according to claim 33 wherein the first carrier member is formed of an aluminum alloy.

35. The planet gear carrier according to claim 1 wherein the first carrier member includes a pinion pin opening, and further comprising a bushing disposed in the pinion pin opening.

36. The planet gear carrier according to claim 1 wherein the first carrier member is formed from a different material than the second carrier member.

37. The planet gear carrier according to claim 36 wherein the first carrier member is formed of a light alloy metal.

38. The planet gear carrier according to claim 37 wherein the first carrier member is formed of an aluminum alloy.

39. The planet gear carrier according to claim 1 wherein the first carrier member includes a guide rib that engages the second carrier member.

40. A hub transmission comprising:

a hub axle;

a driver rotatably supported to the hub axle;

a hub shell rotatably supported to the hub axle;

a planetary gear mechanism disposed between the driver and the hub shell for communicating rotational power from the driver to the hub shell through a plurality of power transmission paths, wherein the planetary gear mechanism comprises:

a first carrier member including a first carrier member axle opening receiving the hub axle therethrough and including a plurality of first planet gear openings for receiving a

plurality of first planet gears therein;

22 a separate second carrier member having a second carrier member axle opening receiving the hub axle therethrough; and

wherein the first carrier member is fastened to the second carrier member.

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